

CLAIMS

What is claimed is:

1. A self-contained, temperature-change container assembly comprising:
an inner container;
an outer jacket at least partially surrounding the inner container, wherein a first internal volume and a second internal volume are defined between the inner container and the outer jacket;
a first temperature-change reagent inside the first internal volume;
a second temperature-change reagent inside the second internal volume;
a reagent separator between the first internal volume and the second internal volume;
a movable member situated opposite the reagent separator; and
at least three penetrators situated on the movable member;
wherein movement of the movable member urges the penetrators through the reagent separator to produce a plurality of spaced-apart openings through the reagent separator and to allow mixing of the first and second temperature-change reagents through said plurality of openings, wherein each of the penetrators produces a single opening spaced apart from the other openings produced by the other penetrators.
2. The container assembly of claim 1, wherein the inner container is a cylindrical metal can of a standard size.
3. The container assembly of claim 1, wherein the movable member is a flexible jacket bottom, wherein the outer jacket comprises a jacket top ring disposed around a top surface of the inner container and a jacket body secured to the jacket

top ring and disposed around the inner container, and wherein the flexible jacket bottom is secured to the jacket body.

4. The container assembly of claim 1, wherein mixing the first and second temperature-change reagents initiates an exothermic reaction to increase the temperature of the inner container.

5. The container assembly of claim 4, wherein the first temperature-change reagent is calcium oxide and the second temperature-change reagent is water.

6. The container assembly of claim 1, wherein mixing the first and second temperature-change reagents initiates an endothermic reaction to reduce the temperature of the inner container.

7. The container assembly of claim 1, wherein the reagent separator comprises a thin membrane.

8. The container assembly of claim 7, wherein the thin membrane comprises a plastic film.

9. The container assembly of claim 7, wherein the thin membrane comprises a metal foil.

10. The container assembly of claim 1, wherein the reagent separator is located at a step on an inner wall of the outer jacket.

11. The container assembly of claim 1, wherein the movable member is a flexible member movable under pressure applied to the movable member on a side of the movable member opposite the second internal volume.

12. The container assembly of claim 1, wherein the penetrators mounted on the movable member include at least five penetrators spaced apart from one another opposite the reagent separator.

13. The container assembly of claim 12, wherein the penetrators mounted on the movable member include at least nine penetrators spaced apart from one another opposite the reagent separator.

14. The container assembly of claim 1, and further comprising a steam condenser in at least one of the first and second internal volumes.

15. The container assembly of claim 14, wherein the steam condenser comprises a material having a high thermal conductivity in direct contact with the material of the inner container.

16. The container assembly of claim 14, wherein the steam condenser comprises steel wool.

17. The container assembly of claim 14, wherein the inner container includes a top surface exposed outside of the jacket, wherein the steam condenser comprises steel wool in the first internal volume, and wherein the steam condenser is in direct contact with the inner container near the top surface of the inner container.

18. The container assembly of claim 1, and further comprising a thermal insulator in the first internal volume between the outer jacket and the first temperature change reagent.

19. A self-contained, temperature-change container assembly comprising:
an inner container;
an outer jacket at least partially surrounding the inner container, wherein a first internal volume and a second internal volume are defined between the inner container and the outer jacket;
a first temperature-change reagent inside the first internal volume;
a steam condenser inside at least one of the first and second internal volumes;
a second temperature-change reagent inside the second internal volume;
a reagent separator between the first internal volume and the second internal volume;
a movable member situated opposite the reagent separator; and
at least one penetrator situated on the movable member;
wherein movement of the movable member urges the penetrator through the reagent separator to breach the reagent separator and to allow mixing of the first and second temperature-change reagents through said breach.

20. The container assembly of claim 19, wherein the inner container is a cylindrical metal can of a standard size.

21. The container assembly of claim 19, wherein the movable member is a flexible jacket bottom, wherein the outer jacket comprises a jacket top ring disposed around a top surface of the inner container and a jacket body secured to the jacket top ring and disposed around the inner container, and wherein the flexible jacket bottom is secured to the jacket body.

22. The container assembly of claim 19, wherein mixing the first and second temperature-change reagents initiates an exothermic reaction to increase the temperature of the inner container.

23. The container assembly of claim 22, wherein the first temperature-change reagent is calcium oxide and the second temperature-change reagent is water.

24. The container assembly of claim 19, wherein mixing the first and second temperature-change reagents initiates an endothermic reaction to reduce the temperature of the inner container.

25. The container assembly of claim 19, wherein the reagent separator comprises a thin membrane.

26. The container assembly of claim 25, wherein the thin membrane comprises a plastic film.

27. The container assembly of claim 25, wherein the thin membrane comprises a metal foil.

28. The container assembly of claim 19, wherein the reagent separator is located at a step on an inner wall of the outer jacket.

29. The container assembly of claim 19, wherein the movable member is a flexible member movable under pressure applied to the movable member on a side of the movable member opposite the second internal volume.

30. The container assembly of claim 19, wherein the at least one penetrator comprises at least three penetrators mounted on the movable member and spaced apart from one another opposite the reagent separator.

31. The container assembly of claim 30, wherein the at least one penetrator comprises at least five penetrators mounted on the movable member and spaced apart from one another opposite the reagent separator.

32. The container assembly of claim 31, wherein the at least one penetrator comprises at least nine penetrators spaced apart from one another opposite the reagent separator.

33. The container assembly of claim 19, wherein the steam condenser comprises a material having a high thermal conductivity in direct contact with the material of the inner container.

34. The container assembly of claim 19, wherein the steam condenser comprises steel wool.

35. The container assembly of claim 19, wherein the inner container includes a top surface exposed outside of the outer jacket, wherein the steam condenser comprises steel wool in the first internal volume, and wherein the steam condenser is in direct contact with the inner container near the top surface of the inner container.

36. The container assembly of claim 19, and further comprising a thermal insulator in the first internal volume between the outer jacket and the first temperature change reagent.

37. A self-contained, temperature-change container assembly comprising:
an inner container;
a jacket top ring disposed around a top surface of the inner container;
a jacket body disposed around the inner container;

a flexible jacket bottom secured to the jacket body, wherein the jacket top ring, the jacket body, and the jacket bottom enclose a first internal volume and a second internal volume outside of the inner container;

a reagent separator between the first internal volume and the second internal volume;

a first temperature-change reagent in the first internal volume;

a second temperature-change reagent in the second internal volume;

a steam condenser in at least one of the first and second internal volumes;

and

a plurality of penetrators fixed to the jacket bottom;

wherein flexing the jacket bottom presses the penetrators through the reagent separator to breach the reagent separator and form a plurality of openings in the reagent separator to allow the first and second temperature-change reagents to mix to initiate a chemical temperature-change reaction.

38. The container assembly of claim 37, wherein the jacket body is fixed to the jacket top ring.

39. The container assembly of claim 37, wherein the jacket body and the jacket top ring are formed integral with one another as a single piece.

40. The container assembly of claim 37, wherein the inner container is a cylindrical metal can of a standard size.

41. The container assembly of claim 37, wherein mixing the first and second temperature-change reagents initiates an exothermic reaction to increase the temperature of the inner container.

42. The container assembly of claim 41, wherein the first temperature-change reagent is calcium oxide and the second temperature-change reagent is water.

43. The container assembly of claim 37, wherein mixing the first and second temperature-change reagents initiates an endothermic reaction to reduce the temperature of the inner container.

44. The container assembly of claim 37, wherein the reagent separator comprises a thin membrane.

45. The container assembly of claim 44, wherein the thin membrane comprises a plastic film.

46. The container assembly of claim 44, wherein the thin membrane comprises a metal foil.

47. The container assembly of claim 37, wherein the reagent separator is located at a step on an inner wall of the jacket body.

48. The container assembly of claim 37, wherein the plurality of penetrators fixed to the jacket bottom includes at least three penetrators spaced apart from one another opposite the reagent separator.

49. The container assembly of claim 48, wherein the plurality of penetrators includes at least five penetrators.

50. The container assembly of claim 49, wherein the plurality of penetrators includes at least nine penetrators.

51. The container assembly of claim 37, wherein the steam condenser comprises a material having a high thermal conductivity in direct contact with the material of the inner container.

52. The container assembly of claim 37, wherein the steam condenser comprises steel wool.

53. The container assembly of claim 37, wherein the inner container includes a top surface exposed outside of the jacket top ring, wherein the steam condenser comprises steel wool, and wherein the steam condenser is in direct contact with the inner container near the top surface of the inner container.

54. The container assembly of claim 37, and further comprising a thermal insulator in the first internal volume between the jacket body and the first temperature change reagent.

55. A method for delivering a packaged product for sale to consumers, the method comprising:

- packaging the product inside a plurality of standard containers;
- designating first and second portions of the plurality of standard containers
- delivering the first portion of the plurality of standard containers with the product packaged inside to a first location for sale to consumers;
- delivering the second portion of the standard containers with the product packaged inside to a second location for further assembly;
- assembling a jacket around each of the standard containers of the second portion of the plurality of standard containers;
- providing an interior volume inside each of the jackets and outside each of the standard containers of the second portion of the packaged product with a first temperature change reagent, a second temperature change reagent, a reagent separator disposed to separate the first and second temperature change reagents,

and a user-operable mechanism for breaching the reagent separator to form self-contained temperature-change container assemblies from the second portion of the plurality of standard containers; and

delivering the self-contained temperature-change container assemblies to a location for sale to consumers.

56. A method for assembling a self-contained temperature-change container assembly, the method comprising:

packaging a product inside a sealed container;

installing a jacket top ring around a top surface of the sealed container;

installing a jacket body around the sealed container;

filling a first temperature-change reagent inside the jacket body and outside the sealed container in a first internal volume inside the jacket body;

providing a reagent separator inside the jacket body and outside the first temperature-change reagent;

filling a second temperature-change reagent inside the jacket body with the reagent separator between the second temperature-change reagent and the first temperature-change reagent; and

installing a jacket bottom onto the jacket body;

wherein the jacket bottom is provided with a user-operable mechanism for breaching the reagent separator to allow the first and second temperature-change reagents to mix.

57. The method of claim 56, wherein installing the jacket top ring around the top surface of the sealed container includes fixing the jacket top ring to the sealed container with an adhesive.

58. The method of claim 56, wherein installing the jacket body on the jacket top ring includes fixing the jacket body to the jacket top ring.

59. The method of claim 58, wherein fixing the jacket body to the jacket top ring includes a process selected from the group consisting of adhesive fixation, thermal welding, sonic welding, and spin welding.

60. The method of claim 56, wherein the jacket top ring and the jacket body are formed integral with one another and the jacket top ring and the jacket body are mounted to the sealed container as a single piece.

61. The method of claim 56, and further comprising installing a steam condenser between the sealed container and the jacket body before filling the first temperature-change reagent inside the jacket body.

62. The method of claim 61, wherein installing the steam condenser includes filling a quantity of steel wool inside the jacket body and outside but in contact with the sealed container.

63. The method of claim 56, wherein providing the reagent separator includes providing a membrane inside the jacket body and outside the first temperature-change reagent.

64. The method of claim 63, and further comprising fixing an edge of the membrane to a step on an inside surface of the jacket body.

65. The method of claim 63, and further comprising fixing the membrane inside the jacket body using a process selected from the group consisting of thermal welding and press welding.

66. The method of claim 56, wherein filling the second temperature-change reagent inside the jacket body includes filling water inside the jacket body over the reagent separator.

67. The method of claim 56, wherein installing the jacket bottom onto the jacket body includes fixing the jacket bottom onto the jacket body using a process selected from the group consisting of adhesive fixation, thermal welding, sonic welding, and spin welding.

68. The method of claim 56, and further comprising placing a thermal insulator inside the jacket body between the jacket body and the first-temperature change reagent.

69. A reagent mixture for use in combination with liquid water in a self-contained temperature change container assembly, the reagent mixture comprising:
calcium oxide;
oxalic acid; and
an inert material.

70. The reagent mixture of claim 69, wherein the inert material is mineral oil.

71. The reagent mixture of claim 69, wherein the ratio of calcium oxide to oxalic acid is between 1:0 and 10:3, by weight.

72. The reagent mixture of claim 69, wherein the amount of mineral oil in the mixture is between 0 and 15%, by weight.